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in stratified media Project: w17_multirti

Author(s): Livescu, Daniel
Wieland, Scott A.
Reckinger, Scott

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Multi-modal investigations of compressible Rayleigh-Taylor instability in stratified media

Project: w17_multirti

PI: Daniel Livescu (CCS-2)

Other users: Scott Wieland (CCS-2 and University of Colorado, Boulder), Scott Reckinger (Montana State University)

The role of background stratification on RTI (IC project: w15_multirti)

1. RTI is suppressed with isothermal and accelerated with isopycnic stratifications

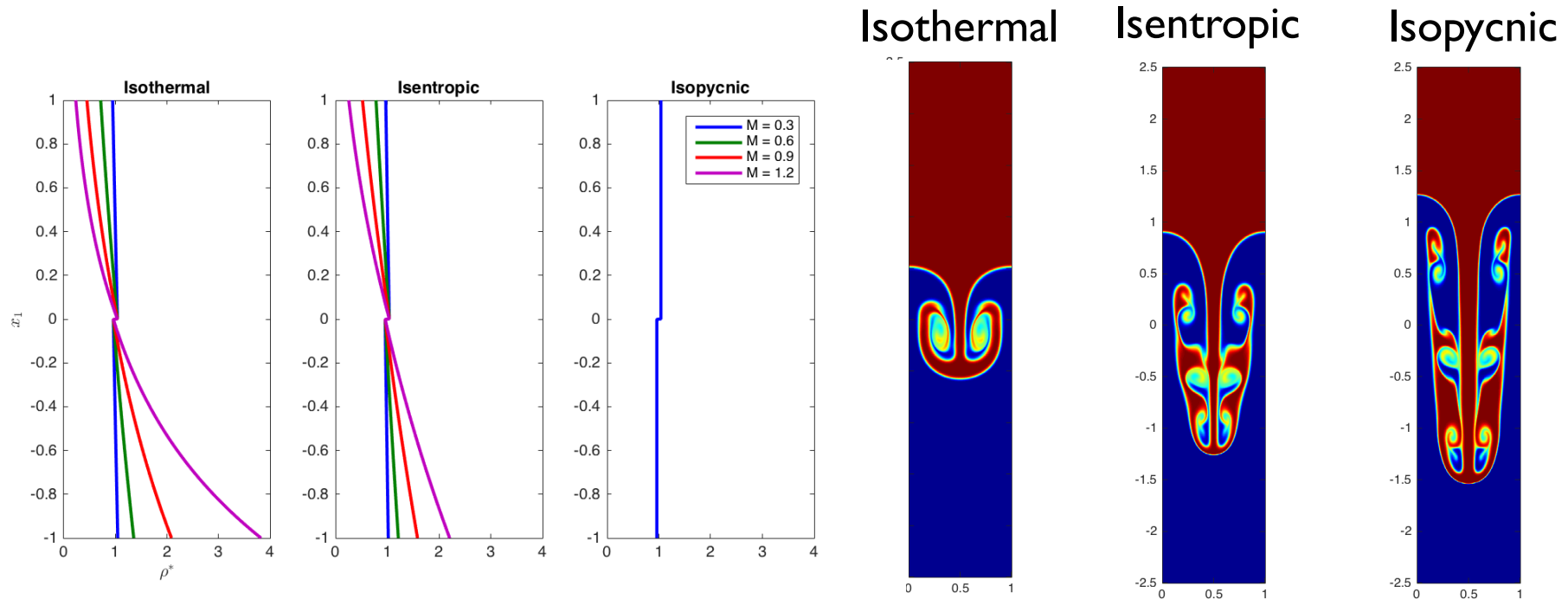


Figure 1. a) Initial background density variation, b) intermediate-time density iso-contours for 3 stratification types.

- Rayleigh-Taylor instability (RTI) often occurs in practice in the presence of complicating effects such as compressibility. Yet most RTI studies so far have only been concerned with the incompressible case. To remedy this, the role of compressibility on the RTI development has been investigated using an adaptive wavelet based code [1].
- Our previous studies showed that compressibility cannot be characterized by a single parameter and that the background stratification can play a significant role.
- The simulations compare, for the first time, three practically important background stratifications under thermal equilibrium and out of equilibrium (isentropic, isopycnic) and show significant differences on the instability growth.

The role of background stratification on RTI (IC project: w17_multirti)

2. Background stratification mechanism to inhibit or accelerate the instability has been identified.

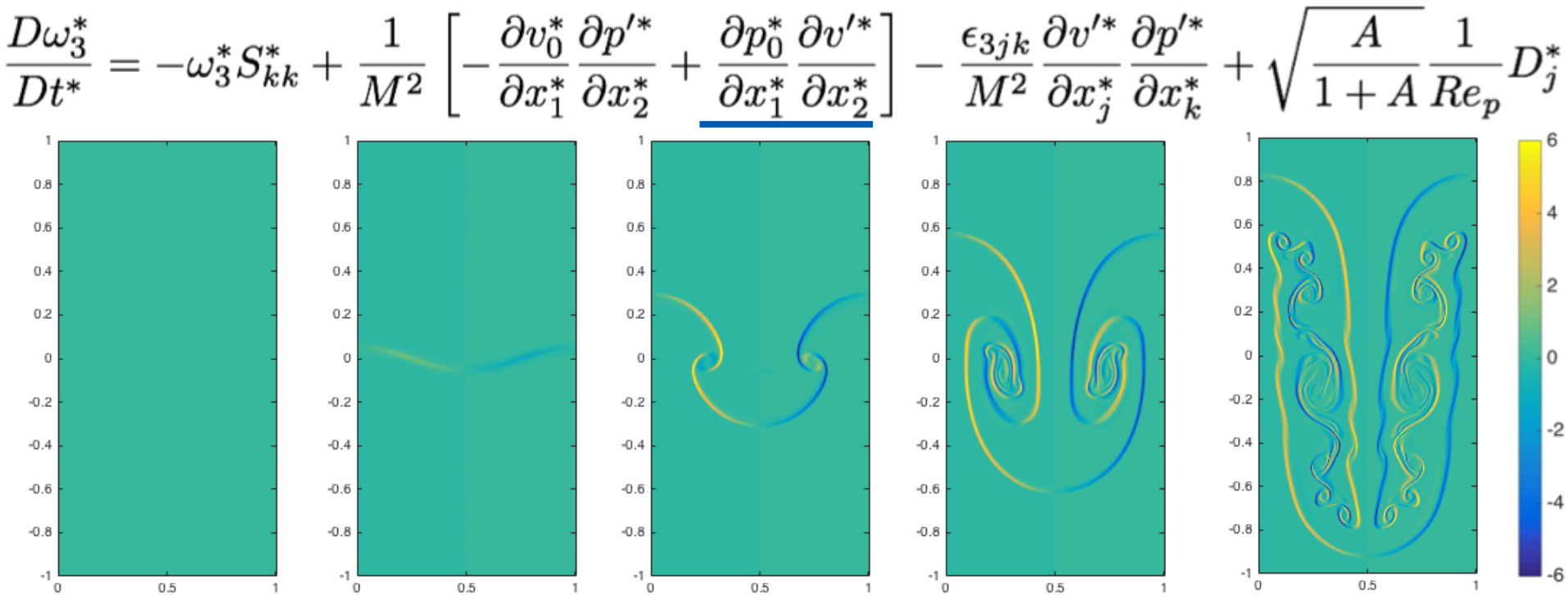


Figure 2. The dominant term in the vorticity transport equation.

- To understand the role of the background stratification on the RTI growth, we considered the vorticity equation, recast in the form where the contributions from the background state are explicitly separated.
- The results show that the term underlined above is the primarily responsible for the effects of background stratification.

The role of background stratification on RTI (IC project: w17_multirti)

3. Multi-mode simulations show similar results to the single-mode case, but on a faster time-scale.

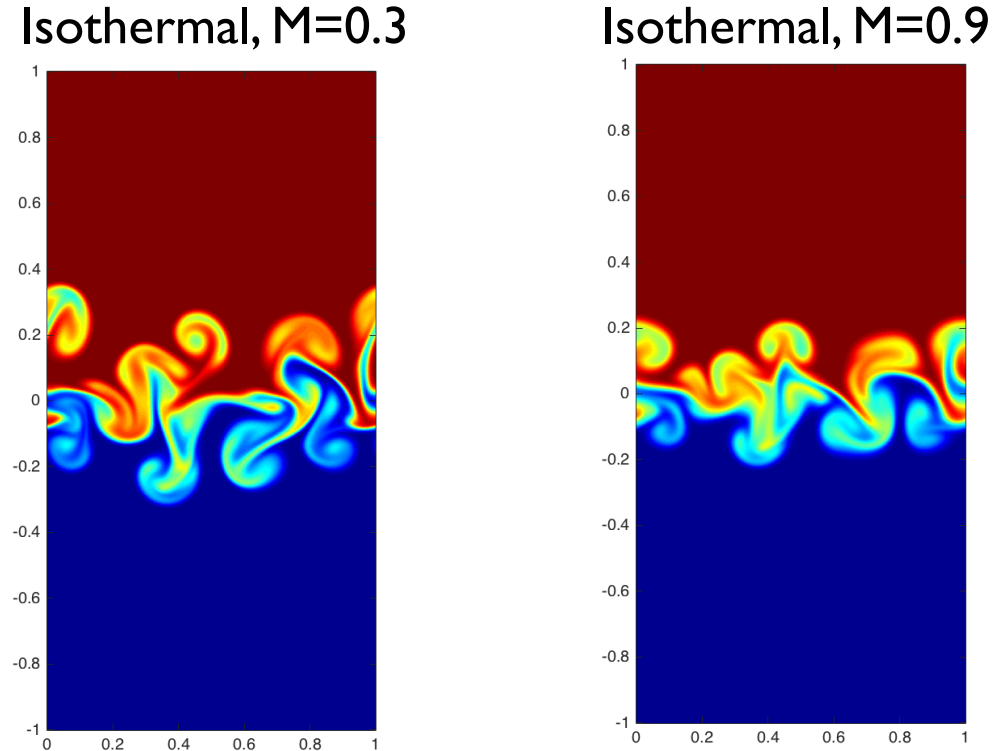


Figure 3. Density contours for the multi-mode case with isothermal background stratification and different stratification strengths.

- Simulations have also been extended to the multi-mode case.
- All single-mode results carry over to the multi-mode case, but on a quicker time scale.
- The results are being used to constrain the mix models under development at LANL.